CHAPTER

6 Targeted and theranostic applications for nanotechnologies in medicine

SUBCHAPTER

6.1 Multifunctional magnetic nanoparticles for cancer treatment

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1 INTRODUCTION

Cancer remains one of the most lethal and often an untreatable disease. Cancer has become the second leading cause of death followed by heart disease in the United States.[1] There are different treatment modalities available for patients based on their stage of the disease and its characteristics. Typically, cancer therapeutic options are surgery, chemotherapy, radiotherapy, hormonal therapy, immunotherapy, and combinations of any of these depending on the necessity. Efficacy of anticancer drugs is hampered because of systemic degradation, poor bioavailability, unsatisfactory pharmacokinetic profile, drug resistance, and side effects. Nanoparticles are capable of targeting tumors efficiently with the help of unique characteristics, such as the "enhanced permeation and retention" (EPR) effect. The lower size of nanoparticles is beneficial for increased surface area to volume ratio that leads to higher surface attachment capacity.[2] Prolonged systemic circulation improves delivery of drug and genetic materials to its intracellular target. Efficient internalization of the nanoparticle leads to reduced cellular toxicity by minimizing the off-target effects.

Nanotechnology has been efficacious at a commercial scale because of the modernized electronics and energy sector.[3] Research in targeted drug delivery using magnetic micro- and nanoparticles began 40 years ago.[4] Nanotechnology is related to materials and devices in a nanometer scale of 1–100 nm in dimension. Among various

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